Space Weather Forecast

Issued on Wednesday, 19 July 2023 at 13:06 Local

This forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Minor/Moderate R1/R2 Blackouts likely throughout. Chance of Minor/Moderate Geomagnetic Storms Day 2 and Day 3.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was Moderate, with several M-class flares observed. The largest one was a long duration and complex M2.1 flare peaking at 18/2027 UTC and attributed to two distinct regions emitting roughly at the same time. There are currently up to eight sunspot regions on the visible disc, two of which are large, rather complex and near the central meridian. An active region has recently rotated onto the far side but has since been replaced by a new large region in the northeast quadrant.

Several Coronal Mass Ejections (CME) were observed over the past 24 hours, most of which are not Earth-directed. However the CME that was observed leaving the Sun from the northeast limb around the same time as the M2.1 flare has been analysed. While the bulk of the ejecta is believed to head west of the Sun-Earth line, it may give a glancing blow on Day 3 (21st). Timing is still uncertain since a second analysis came back with a very different velocity.

Solar Wind / Geomagnetic Activity: The solar wind parameters are indicative of a gradual return to a slow regime. The solar wind slowly declined from 490 to 410km/s. The Interplanetary Magnetic Field has been weak, with its important north-south component mostly orientated northward. This resulted in a mostly Quiet geomagnetic activity. One Active (Kp4) interval was however observed between 18/1800-2100UTC, this most likely attributed to the disconnection with the magnetic cloud associated with the CME which arrived at Earth on 16 July.

Energetic Particles / Solar Radiation: The count rate of energetic particles (high energy protons) is displaying a slight declining trend but remained above the Minor (S1) Storm threshold following the M5.7 flare that occurred on the 18/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Activity is expected to be Moderate over the following days, with occasional M-class flares likely. The two most likely candidates are currently in the northeast quadrant.

Solar Wind / Geomagnetic Activity: Two Earth-directed CMEs feature in this forecast, with a glancing blow expected on Day 2 (20th) and another one on Day 3 (21st). However confidence is very low with regards to the strength and timing of the second CME. Connections with coronal hole high speed streams may become established at times but these are small and most likely to be masked by CME effects. Solar winds should remain slightly elevated on Day 1 but become mostly elevated and perhaps strong at times on Days 2 and 3, before slowly easing on Day 4.

Geomagnetic activity is therefore expected to be Quiet to Unsettled on day 1 (19th). Activity then probably becoming Active with a chance of G1/G2 (Minor/Moderate) storms intervals on days 2

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and 3 (20th & 21st). Activity returning to Quiet with a chance of Unsettled intervals by day 4 (22nd) as CME effects wane, but confidence is low as it will largely depends on the arrival time of the CME.

Energetic Particles / Solar Radiation: Currently the ongoing minor solar radiation storm will probably continue for much of the guidance period, especially if another significant proton rich flare is emitted.

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Geomagnetic Storms:

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	50	30	10
Strong	G3	No	1	10	10	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X Ray Flares:

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	Yes	70	70	70	70
Very Active	R3 to R5 X	No	10	15	20	20

Solar Radiation Storms - (High Energy Protons):

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	Yes	100	80	70	60
Very Active	≥ S3 *	No	10	5	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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